

1 USING MULTIPLE COMMUNICATION CHANNELS TO SYNCHRONIZE A MOBILE 2 TERMINAL BASED ON DATA TYPE 3

4 Cross Reference to Related Applications and Patents

5 This application is related to co-pending U.S. patent applications serial no. 09/____,____
6 entitled "MULTI-SITED DISTRIBUTED SYNCHRONIZATION OF A MOBILE
7 TERMINAL", and serial no. 09/____,____ entitled "MOBILE TERMINAL SYNCHRONIZING
8 COMPONENTS OF A DOCUMENT SEPARATELY" the disclosures of which are herein
9 incorporated by reference.

10 BACKGROUND OF THE INVENTION

11 Field of the Invention

12 The present invention relates to mobile terminals. More particularly, the present invention
13 relates to using multiple communication channels to synchronize a mobile terminal based on data
14 type.

15 Description of the Prior Art

16 Mobile terminals, such as handheld computers, cellular telephones, tablet computers etc.,
17 are typically used to view and manipulate various databases, such as personal information
18 management (PIM) data, emails, and web sites. The mobile terminal is typically synchronized
19 when the databases are updated, for example, when the user modifies PIM data on a target
20 computer or when the contents of a web site change. FIG. 1 illustrates a prior art technique for
21 synchronizing a mobile terminal 2 over a local connection 6 (e.g., a USB connection) to databases
22 stored on a target computer 4 as well as web pages stored on the Internet.

23 FIG. 2 illustrates various configurations for remotely synchronizing the mobile terminal 2
24 to the target computer 4 via the Internet 8. The mobile terminal may access the Internet 8 over
25 telephone lines 14 using a modem communicating with an Internet service provider (ISP) 16.
26 Alternatively, the mobile terminal 2 may access the Internet 8 via a wireless connection, such as a
27 cellular provider network (CPN) 18, or a wireless access point (WAP) 20 such as Bluetooth,

1 802.11b, or HomeRF. In yet another configuration, the mobile terminal 2 may access the Internet
2 through a remote computer 22 connected to the Internet. In each of these configurations all of
3 the synchronization data is routed through the target computer 4, creating a bottleneck that can
4 significantly extend the synchronization session. This is undesirable because it increases the
5 access latency to the synchronized data, and for a remote connection (e.g., a wireless connection),
6 it can increase the connection fees and decreases the battery life of the mobile terminal 2. Further,
7 some of the synchronization data may be private data and inaccessible through a public
8 communication channel via the target computer 4. A user may synchronize the mobile terminal
9 over more than one communication channel (e.g., a public communication channel and a private
10 communication channel), but this requires manually configuring the mobile terminal to perform
11 multiple synchronization sessions over the various communication channels.

12 There is, therefore, a need to improve upon the current processes for synchronizing a
13 mobile terminal to synchronization data, such as web sites, emails, and PIM data.

14 SUMMARY OF THE INVENTION

15 The present invention may be regarded as a method of operating a mobile terminal during
16 a synchronization session. A plurality of data types, including a first data type and a second data
17 type, are identified to synchronize with the mobile terminal. A first communication channel and a
18 second communication channel are identified, and a rule base is applied to assign the first data
19 type to the first communication channel and the second data type to the second communication
20 channel. Synchronization data of the first data type is exchanged over the first communication
21 channel, and synchronization data of the second data type is exchanged over the second
22 communication channel.

23 In one embodiment the first data type identifies public data and the second data type
24 identifies private data. In another embodiment, the first data type identifies data having a first
25 size, and the second data type identifies data having a second size smaller than the first size.

26 In one embodiment, the first communication channel having a first bandwidth, and the
27 second communication channel having a second bandwidth less than the first bandwidth. In yet

1 another embodiment, the first communication channel having a first connection cost, and the
2 second data communication channel having a second connection cost less than the first
3 bandwidth. In one embodiment the first communication channel comprises a short-range wireless
4 access point, and the second communication channel comprises a long-range cellular provider
5 network.

6 In yet another embodiment, synchronization data is exchanged over the first
7 communication channel substantially concurrent with exchanging synchronization data over the
8 second communication channel.

9 In still another embodiment, the mobile terminal for communicating with a first target
10 computer over the first communication channel and for communicating with a second target
11 computer over the second communication channel, wherein the mobile terminal transmits an
12 identifier to the first target computer for identifying the second target computer.

13 The present invention may also be regarded as a method of operating a mobile terminal
14 during a synchronization session, wherein the mobile terminal for communicating with at least one
15 target computer, the target computer for applying a rule base for assigning a first data type to a
16 first communication channel and a second data type to a second communication channel. The
17 method comprises the steps of identifying the first communication channel and the second
18 communication channel, and exchanging synchronization data of the first data type over the first
19 communication channel and exchanging synchronization data of the second data type over the
20 second communication channel.

21 The present invention may also be regarded as a method of operating a first target
22 computer to synchronize a mobile terminal over a first communication channel and over a second
23 communication channel during a synchronization session, the mobile terminal for identifying the
24 first communication channel and the second communication channel. The method comprises the
25 steps of identifying a plurality of data types, including a first data type and a second data type, to
26 synchronize with the mobile terminal, and applying a rule base to assign the first data type to the
27 first communication channel and the second data type to the second communication channel.

1 The present invention may also be regarded as a mobile terminal comprising a screen, a
2 local memory, and a terminal controller. The terminal controller for synchronizing the mobile
3 terminal during a synchronization session. The terminal controller identifies a plurality of data
4 types, including a first data type and a second data type, to synchronize with the mobile terminal.
5 The terminal controller also identifies a first communication channel and a second communication
6 channel. The terminal controller applies a rule base to assign the first data type to the first
7 communication channel and the second data type to the second communication channel, and
8 exchanges synchronization data of the first data type over the first communication channel and
9 exchanges synchronization data of the second data type over the second communication channel.

10 The present invention may also be regarded as a mobile terminal for communicating with
11 at least one target computer, the target computer for applying a rule base for assigning a first data
12 type to a first communication channel and a second data type to a second communication channel.
13 The mobile terminal comprises a screen, a local memory, and a terminal controller for
14 synchronizing the mobile terminal during a synchronization session. The terminal controller
15 identifies the first communication channel and the second communication channel, and exchanges
16 synchronization data of the first data type over the first communication channel and exchanges
17 synchronization data of the second data type over the second communication channel.

18 The present invention may also be regarded as a target computer for synchronizing a
19 mobile terminal over a first communication channel and over a second communication channel
20 during a synchronization session, the mobile terminal for identifying the first communication
21 channel and the second communication channel. The target computer comprise a local memory
22 and a controller for identifying a plurality of data types, including a first data type and a second
23 data type, to synchronize with the mobile terminal and applying a rule base to assign the first data
24 type to the first communication channel and the second data type to the second communication
25 channel.

26 The present invention may also be regarded as a computer program embodied on a
27 computer readable storage medium for use in a mobile terminal, the computer program for

1 synchronizing the mobile terminal during a synchronization session. The computer program
2 comprises a code segment for identifying a plurality of data types, including a first data type and a
3 second data type, to synchronize with the mobile terminal. The computer program further
4 comprises a code segment for identifying a first communication channel and a second
5 communication channel. The computer program further comprises code segments for applying a
6 rule base to assign the first data type to the first communication channel and the second data type
7 to the second communication channel, and exchanging synchronization data of the first data type
8 over the first communication channel and exchanging synchronization data of the second data
9 type over the second communication channel.

10 The present invention may also be regarded as a computer program embodied on a
11 computer readable storage medium for use in a mobile terminal, the computer program for
12 synchronizing the mobile terminal during a synchronization session. The mobile terminal for
13 communicating with at least one target computer, the target computer for applying a rule base for
14 assigning a first data type to a first communication channel and a second data type to a second
15 communication channel. The computer program comprises code segments for identifying the first
16 communication channel and the second communication channel, and exchanging synchronization
17 data of the first data type over the first communication channel and exchanging synchronization
18 data of the second data type over the second communication channel.

19 The present invention may also be regarded as a computer program embodied on a
20 computer readable storage medium for use in a target computer. The target computer for
21 synchronizing a mobile terminal over a first communication channel and over a second
22 communication channel during a synchronization session, the mobile terminal for identifying the
23 first communication channel and the second communication channel. The computer program
24 comprises code segments for identifying a plurality of data types, including a first data type and a
25 second data type, to synchronize with the mobile terminal, and applying a rule base to assign the
26 first data type to the first communication channel and the second data type to the second
27 communication channel.

1 **BRIEF DESCRIPTION OF THE DRAWINGS**

2 FIG. 1 shows a prior art configuration wherein a mobile terminal is synchronized to a
3 target computer over a direct wired connection.

4 FIG. 2 shows a prior art configuration wherein a mobile terminal is synchronized remotely
5 to the target computer over a wired connection (e.g., telephone land lines) or over a wireless
6 network via the Internet.

7 FIG. 3 shows a configuration according to an embodiment of the present invention for
8 synchronizing a mobile terminal over multiple communication channels based on data type.

9 FIG. 4 is a flow chart according to an embodiment of the present invention illustrating the
10 steps executed to synchronize a mobile terminal over multiple communication channels based on
11 data type.

12 FIG. 5A shows a mobile terminal according to an embodiment of the present invention
13 comprising a terminal controller for exchanging various types of synchronization data over
14 respective communication channels.

15 FIG. 5B shows a mobile terminal according to an embodiment of the present invention
16 comprising a disk for non-volatile storage of the synchronization data.

17 **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

18 FIG. 4 is a flow chart according to an embodiment of the present invention illustrating the
19 steps executed to synchronize a mobile terminal over multiple communication channels during a
20 synchronization session. At step 24 a plurality of data types, including a first data type and a
21 second data type, are identified to synchronize with the mobile terminal. At step 26 a first
22 communication channel and a second communication channel are identified for use in
23 synchronizing the mobile terminal. At step 28 a rule base is applied to assign the first data type to
24 the first communication channel and the second data type to the second communication channel.
25 At step 30 synchronization data of the first data type is exchanged over the first communication
26 channel and synchronization data of the second data type is exchanged over the second
27 communication channel.

FIG. 3 shows a configuration illustrating an embodiment of the present invention. A mobile terminal 32 is synchronized to a target computer 34 over the Internet 8 over a first communication channel comprising a CPN 36, and synchronized to a corporate server 38 over a second communication channel comprising a WAP 40. The corporate server 38 is connected to the Internet 8 through a firewall 42 which prevents selected data from passing through the corporate network. For example, the user of the mobile terminal 32 may want to synchronize to PIM data and personal emails stored on the target computer 34. However, this data is not accessible through the Internet 8 via the corporate server 38 because it is blocked by the firewall 42. The firewall 42 may block this data for various reasons, such as security concerns or the desire to restrict corporate bandwidth to corporate data. The user of the mobile terminal 32 may also want to synchronize to PIM data and business emails stored on the corporate server 38. The mobile terminal 32 evaluates the various types of data to be synchronized together with the communication channels available to perform the synchronization. In the example of FIG. 3, the mobile terminal 32 identifies the WAP 40 communication channel for synchronizing to data stored on the corporate server 38, and the CPN 36 communication channel for synchronizing to data stored on the target computer 34.

In one embodiment, the synchronization data comprises public data and private data. Referring again to FIG. 3, the data stored on the corporate server 38 may be private data accessible only by authorized users. Therefore, the mobile terminal 32 selects a private communication channel, such as a private WAP 40 or an encrypted communication channel, to synchronize to the private data stored on the corporate server 38. Other data, such as selected pages from web sites, may be public data accessible by anyone. Therefore, the mobile terminal 32 selects a public channel, such as a public CPN 36 or other unencrypted channel for accessing the Internet 8, to synchronize to the public data.

In another embodiment, the synchronization data comprises data types of varying size, and the mobile terminal 32 selects the appropriate communication channel relative to quality of service issues, such as cost and bandwidth. For example, it may be desirable to transmit large data types,

1 such as images or email attachments, over a wired communication channel having a high
2 bandwidth and low connection cost. Smaller data types, such as the text of an email or a web
3 page, may be transmitted over a lower bandwidth communication channel having a higher
4 connection cost, such as a CPN. Referring again to FIG. 3, large data types may be transmitted
5 via the short-range WAP 40 and corporate server 38 whereas smaller data types may be
6 transmitted over the long-range CPN 36 via the Internet 8.

7 Any suitable communication channel may be used to synchronize the mobile terminal 32,
8 including a wired or wireless modem, Ethernet, CPN, or a WAP such as Bluetooth, 802.11b, or
9 HomeRF. The mobile terminal 32 may select two or more of the available communication
10 channels for synchronizing based on data type.

11 In one embodiment, the mobile terminal exchanges synchronization data over a first
12 communication channel substantially concurrent with exchanging synchronization data over a
13 second communication channel. Referring again to FIG. 3, the mobile terminal 32 may exchange
14 synchronization data with the corporate server 38 via the WAP 40 while concurrently exchanging
15 synchronization data with the target computer 34 via the CPN 36 and Internet 8. This
16 embodiment may expedite the synchronization session as well as conserve battery power.

17 In one embodiment, the mobile terminal 32 executes the step of applying the rule base to
18 assign the first data type to the first communication channel and the second data type to the
19 second communication channel. In an alternative embodiment, the step of applying the rule base
20 is executed by a target computer used to synchronize the mobile terminal 32. Referring again to
21 FIG. 3, the corporate server 38 may apply the rule base to assign a first data type to the WAP
22 channel 38 and a second data type to the CPN channel 36. In this embodiment, the mobile
23 terminal 32 identifies the communication channels available for use during the synchronization
24 session, and transmits a list of the available communication channels to the target computer (e.g.,
25 to the corporate server 38).

26 In one embodiment, the mobile terminal 32 communicates with a first target computer
27 over the first communication channel, and with a second target computer over the second

1 communication channel. The first and second target computers communicate with one another to
2 configure the synchronization session. Referring again to FIG. 3, the corporate server 38 may
3 communicate with the target computer 34 to configure the synchronization session so that
4 corporate data and data that can pass through the firewall 42 is synchronized over the WAP
5 channel 40, and all other data is synchronized over the CPN channel 36. In one embodiment the
6 mobile terminal 32 transmits an identifier to the first target computer (e.g., the corporate server
7 38), wherein the identifier identifies the second target computer (e.g., target computer 34). In this
8 manner the first target computer can locate and communicate with the second target computer
9 (e.g., over the Internet 8). Further details of this embodiment are disclosed in the above reference
10 patent application entitled "MULTI-SITED DISTRIBUTED SYNCHRONIZATION OF A
11 MOBILE TERMINAL".

12 In one embodiment, the first data type comprises a first component of a document, and the
13 second data type comprises a second component of a document. Further details of this
14 embodiment are disclosed in the above referenced patent application entitled "MOBILE
15 TERMINAL SYNCHRONIZING COMPONENTS OF A DOCUMENT OVER MULTIPLE
16 COMMUNICATION CHANNELS".

17 FIG. 5A shows a mobile terminal 50 for synchronizing various data types over respective
18 communication channels according to an embodiment of the present invention. The mobile
19 terminal 50 comprises a local memory 52 for storing synchronization data, a screen 54, and a
20 terminal controller 56. At the beginning of a synchronization session, the terminal controller 56
21 identifies a plurality of data types, including a first data type and a second data type, to
22 synchronize with the mobile terminal 50. The terminal controller 56 identifies a first
23 communication channel and a second communication channel, and applies a rule base to assign the
24 first data type to the first communication channel and the second data type to the second
25 communication channel. The terminal controller 56 then exchanges synchronization data of the
26 first data type over the first communication channel and exchanges synchronization data of the
27 second data type over the second communication channel. In the embodiment of FIG. 5A, the

1 mobile terminal 50 further comprises a communication interface 58 for exchanging the
2 synchronization data over the first and second communication channels, and a user interface 60
3 for receiving user input from a key board 62 as well as the screen 54.

4 FIG. 5B shows a mobile terminal 64 according to an embodiment of the present invention
5 wherein the local memory comprises a disk 66. The mobile terminal 64 further comprises
6 components for enabling the disk storage, including a voice coil motor (VCM) 68 and spindle
7 motor 70, a servo controller 72, a preamp 74, a read/write channel 76, and a disk controller 78.
8 In the embodiment of FIG. 5B, the mobile terminal 64 comprises semiconductor memory 80 that
9 is shared by the terminal controller 56 and disk controller 78 to reduce the cost of the mobile
10 terminal 64. In another embodiment, the terminal controller 56 executes a disk caching algorithm
11 for caching data read from and written to the disk 66. In the embodiment of FIG. 5B, the disk 66,
12 VCM 68, spindle motor 70 and preamp 74 are implemented within a head disk assembly (HDA)
13 82, the servo controller 72, read/write channel 76 and disk controller 78 are implemented on a
14 first printed circuit board (PCB) 84, and the terminal controller 56 and semiconductor memory 80
15 are implemented on a second PCB 86. In an alternative embodiment, the servo controller 72,
16 read/write channel 76, disk controller 78, terminal controller 56, and semiconductor memory 80
17 are implemented on a single PCB.

18 In one embodiment, the local memory of the mobile terminal (e.g., the disk 66 in FIG. 5B)
19 stores a computer program comprising a code segment for identifying a plurality of data types,
20 including a first data type and a second data type, to synchronize with the mobile terminal. The
21 computer program further comprises code segments for identifying a first communication channel
22 and a second communication channel, and for applying a rule base to assign the first data type to
23 the first communication channel and the second data type to the second communication channel.
24 The computer program further comprises a code segment for exchanging synchronization data of
25 the first data type over the first communication channel and exchanging synchronization data of
26 the second data type over the second communication channel.